Primary Standards Laboratory

Metrology Program

Fact Sheet

Nuclear

The Primary Standards Laboratory (PSL) and Sandia's Radiation Protection organization maintain a variety of primary nuclear radiation standards to assure accurate and traceable measurements for their customers.

Primary nuclear standards (alpha, beta, gamma, and neutron) are directly traceable to the National Institute of Standards and Technology (NIST).

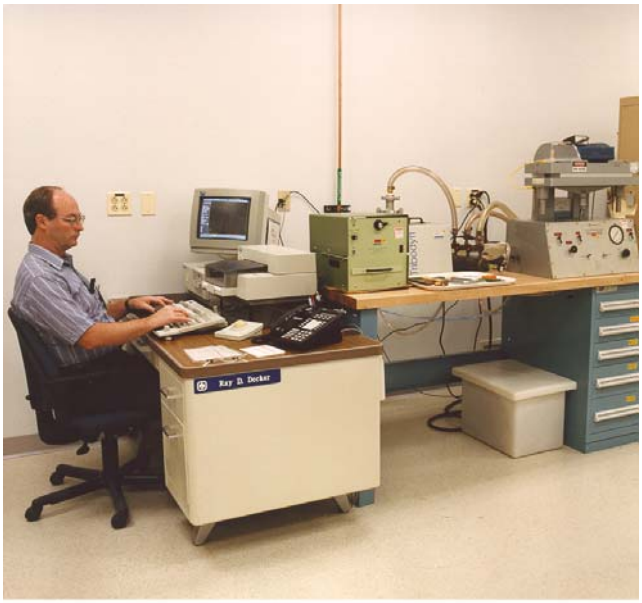
Sandia's nuclear radiation standards include alpha and beta sources, gamma ionization chambers used in conjunction with a gamma source range, steady-state and pulsed neutron sources, and a certified tritiated methane gas bottle. Sandia also maintains a radiation dosimetry program for personnel and the environment.

Seven steady-state, primary neutron sources (Pu-Be, Pu-B and Cf-252) are maintained covering the fluence range 10^6 - $4x10^7$ neutrons/sec, and Am-Be check sources are also available with fluences of about $7x10^4$ neutrons/sec. These primary sources, which are calibrated by NIST, are used on a low-scatter range to certify survey meters and to verify dosimeter response.

The PSL maintains the national standard for pulsed, 14-MeV neutron detection in the form of a lead-activation detector (lead probe). Primary calibration is accomplished using a gated accelerator and associated particle counting, and results are intercompared with the Atomic Weapons Establishment (United Kingdom).

Customer lead probes or other detectors and dosimeters are certified by comparison with the standard using a laboratory neutron generator as the source. Certification is in terms of total neutrons produced at the source target.

Sandia's dosimetry program covers gammas, high-energy betas, and neutrons up to 14-MeV. The program conforms to DOE Laboratory Accreditation Program requirements.



Alpha Source Calibration

A bottle of tritiated methane gas whose activity has been certified is used to set the response of tritium monitors.

Primary alpha and beta sources are calibrated periodically by NIST. The primary sources are used to certify similar sources that are used, in turn, to calibrate survey instruments. An internal gas proportional counter is used for calibration of the thin sources. Results are expressed in terms of emission into 2 π rather than as absolute decay rates because the counter does not distinguish between direct and back-scattered particles. The primary source range of 10^3 - 10^6 counts/min can be extended to 10^1 - 10^7 counts/min with a slight increase in uncertainty.

Gamma ionization chambers covering the range 0.025 - 250 R are calibrated by NIST. Chambers are used to standardize the dose from a source range with Cs-137 energy. The range is used to provide known doses and dose rates (up to a present 700 R/hr) for certifying survey meters, verifying dosimeter response, and exposing items submitted by customers. The Cs-137 range capabilities

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and capacity can be extended with the Model 89-400 Shielded Calibration Range manufactured by J. L. Shepherd.

Capabilities

•NEUTRONS	
Total Pulsed 14 MeV	± 9%
•GAMMA RADIATION	
Gamma Dose/Dose Rate	± 7%
•ALPHA/BETA RADIATION	
Alpha Emission Rate	± 3%
Beta Emission Rate	± 5%
•DOSIMETERS	
Beta, gamma, neutron doses 10 mrem to 10^4 rem	variable

Major Resources

- Internal gas proportional counter for alpha counting
- Gamma source range; Cs-137 source
- Low-scatter neutron test bed; Pu-Be, Pu-B, Cf-252 sources
- Laboratory neutron generator and lead probe test system
- Gated ion accelerator and associated particle counting setup
- Tritium gas-handling system
- TLD counting facility
- Portable radiation monitoring instrument calibration laboratory

Selected Accomplishments

- Sandia successfully completed the last primary lead probe neutron activation detector calibration at the National Physical Laboratory (NPL) SAMES accelerator in Teddington, United Kingdom. This primary lead probe calibration procedure is being reestablished at Sandia (see next accomplishment) and transferred to the Atomic Weapons Establishment (AWE), Aldermaston, United Kingdom.
- Sandia has reestablished its capability to calibrate primary lead probe detectors. This capability is being reestablished at the ion implant accelerator in building 884 belonging to organizations 1111 and 1112. The new beam line uses all ultrahigh vacuum metal parts with an aluminum target chamber. The nuclear control electronics uses the Canberra Genie 2000 software package. The primary lead probe calibration will be compared with the new UK calibration setup at AWE.
- Audited the gamma cell exposure calibration for semiconductor testing at a number of subcontractor sites.
- Participated in the DOE Radiological Intercomparison Program sponsored by Battelle for gamma and neutron radiation fields.
- Sponsored neutron intercomparison measurements for the Treaty Verification Program.

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